SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

IV SEMESTER

ME3463 – STRENGTH OF MATERIALS

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Prepared by

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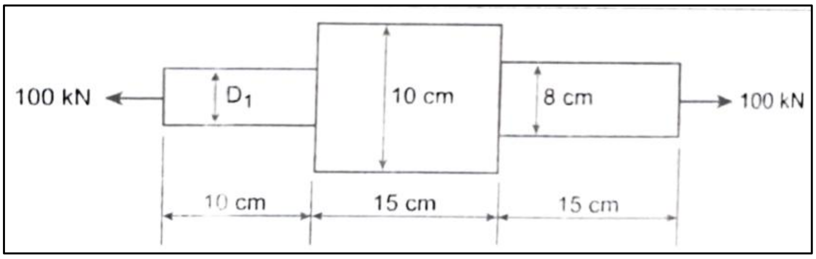
DEPARTMENT OF MECHANICAL ENGINEERING

SUBJECT : ME3463 – STRENGTH OF MATERIALS
YEAR/SEM: II/IV

UNIT-I STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and strains and principal planes – Mohr's circle of stress.

Sl. No	Questions	BTL	Compliance
	PART-A (2 Marks)		
1	Define stiffness.	BT1	Remembering
2	Describe stress and strain.	BT2	Understanding
3	Discriminate simple stress and compound stress.	BT2	Understanding
4	Classify the types of stress and strain.	BT1	Remembering
5	Discriminate shear stress and shear strain.	BT2	Understand
6	Define Hooke's law.	BT1	Remembering
7	Describe about volumetric strain.	BT2	Understanding
8	Describe Young's modulus and Bulk modulus with their expression.	BT1	Remembering
9	List the types of elastic constants.	BT1	Remembering
10	Discriminate longitudinal strain and lateral strain.	BT2	Understanding
11	Formulate the expression for Young's modulus and Bulk modulus.	BT2	Understanding
12	Formulate the expression for Young's modulus and shear modulus.	BT2	Understanding
13	Define Poisson's ratio.	BT1	Remembering
14	Define principal stress and principal strain.	BT1	Remembering
15	What do you understand by a compound bar?	BT1	Remembering
16	Define strain energy density.	BT1	Remembering
17	What do you understand about obliquity?	BT1	Remembering
18	Define factor of safety.	BT1	Remembering
19	Write the expression for volumetric strain of a rectangular bar subjected to axial load.	BT2	Understanding
20	Define Resilience.	BT1	Remembering

21	Write the expression for volumetric strain of a cylindrical rod subjected to axial load.	BT2	Understand
22	Describe about Proof Resilience.	BT1	Remembering
23	Expression for strain energy stored in a body when the load is applied gradually.	BT2	Understanding
24	Expression for strain energy stored in a body when the load is applied suddenly.	BT2	Understanding
25	What do you mean by the term "necking"?	BT1	Remembering
	PART-B (16 Marks)		
1	A hollow cylinder 1.5 m long has an outside diameter of 45 mm and inside diameter of 25 mm. If the cylinder is carrying a load of 20 kN. Find the stress in the cylinder and deformation of the cylinder. Take Young's modulus of the cylinder material is 100 GPa.	BTL5	Evaluate
2	A steel bar 900 mm long and two ends are 40 mm and 30 mm in diameter with the length of each rod is 200 mm. The middle portion of the bar is 15 mm diameter and 500 mm long. If the bar is subjected to an axial tensile load of 15 kN. Determine the following 1. Stress in each section 2. Total extension	BTL5	Evaluate
3	A round bar as shown in **Figure -1** is subjected to an axial tensile load of 100 kN. Determine the diameter of the first part if the shear stress in the in the first part is 100 MN/m^2 and find total elongation of the bar. Take young's modulus of the material is 290 GPa.  **Figure -1**	BTL5	Evaluate
4	A round bar as shown in **Figure -2** is subjected to an axial tensile load of 150 kN. Determine the diameter of the middle portion if the stress is limited to 160 MN/mm^2. Find the length of middle portion, if the total elongation of the bar is 0.25 mm. Take Young's modulus of the material is 200 GN/m^2.	BTL5	Evaluate

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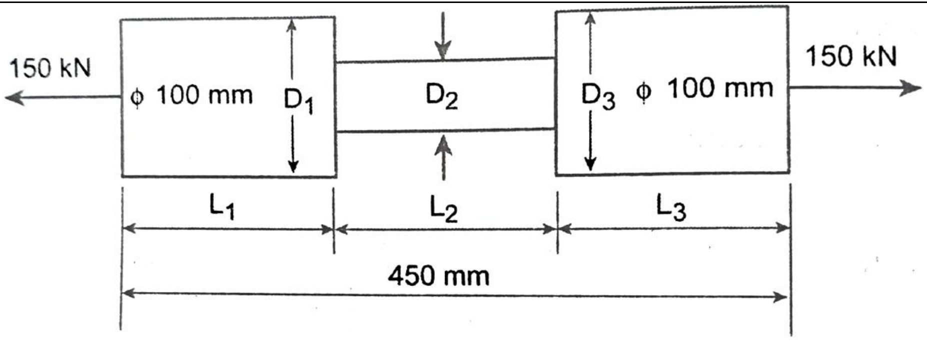
<tr><td></td><td>

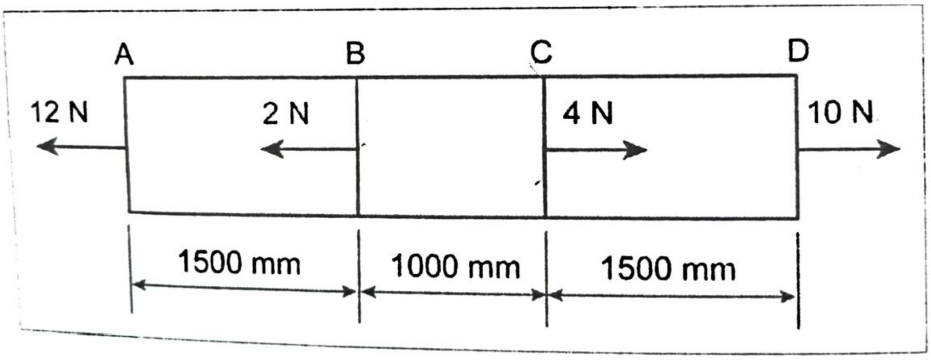
Figure -2</td><td></td><td></td></tr>
<tr><td>5</td><td>A steel rod 50 mm diameter is subjected to a force as shown in Figure-3. Find the elongation of the rod and take E= 2 x 10^5 N/mm^2.


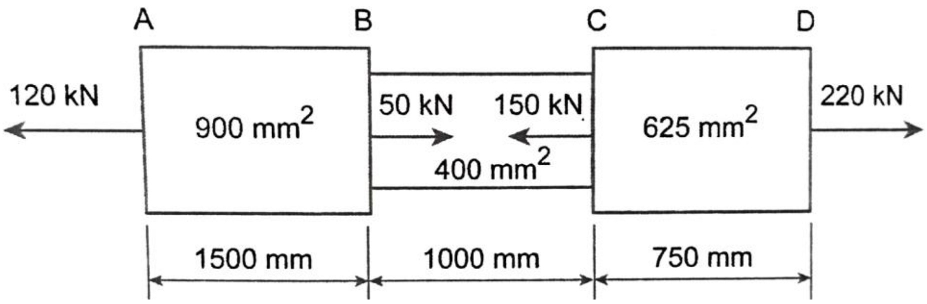
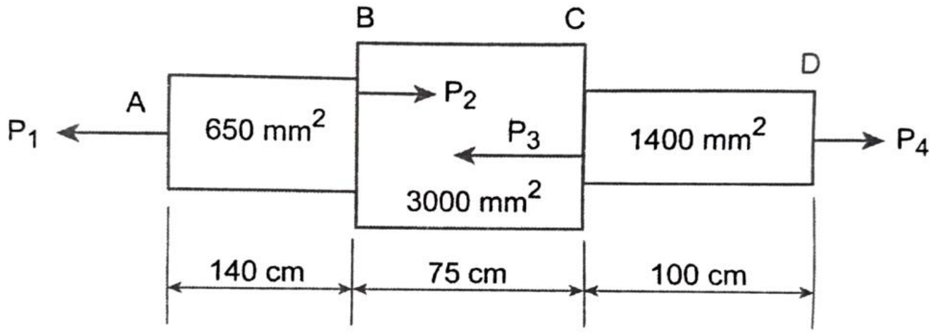
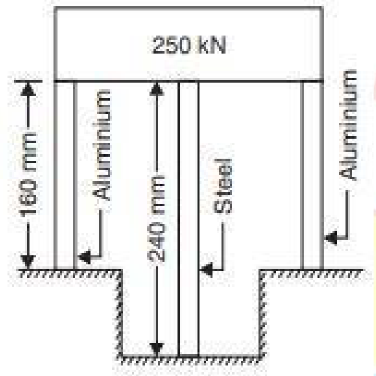
Figure-3.</td><td>BTL5</td><td>Evaluate</td></tr>
<tr><td>6</td><td>A member ABCD is subjected to loading as shown in Figure-4. Determine the total elongation of the material and the value of young's modulus of material is 2 x 10^5 N/mm^2.


Figure-4</td><td>BTL5</td><td>Evaluate</td></tr>
<tr><td>7</td><td>A bar is subjected to point load as shown in Figure-5. Calculate the force P2 and the total elongation of the bar. Take the value of load acting P1 = 60 kN, P3 = 500 kN and P4 = 150 kN and modulus of elasticity is 2.1 x 10^5 N/mm^2.</td><td>BTL5</td><td>Evaluate</td></tr>
</table>

	 **Figure-5**		
8	Three pillars, two of aluminium and one of steel support a rigid platform of 250 kN as shown in **Figure-6.** If area of each aluminium pillar is 1200 mm^2 and that of steel pillar is 1000 mm2, find the stresses developed in each pillar. Take E_s = 2 x 10^5 N/mm^2 and E_a = 1 × 10^6 N/mm^2.  **Figure-6**	BTL5	Evaluate
9	A steel rod of 3 cm diameter is enclosed centrally in hallow copper tube of external and internal diameter of 5 cm and 4 cm respectively. The composite bar is subjected to an axial pull of 45000 N, if the length of each bar is equal to 15 cm. Take the value of Es = 2.1 x 10^5 N/mm^2 and Ec = 1.1 x 10^5 M/mm^2 Determine the following 1. The stress in the rod and tube 2. Load carried by each bar.	BTL5	Evaluate
10	A compound tube which consists of a steel of 140 mm internal diameter and 5 mm thickness and an outer brass tube of 150 mm internal diameter and 5 mm thick. The two tubes are of same length. Compound tube carries an axial load of 600 kN. Find the stresses carried by each tube and amount of shortening. Length of all the tube is 120 mm. Take E_s=2 x 10^5 N/mm^2 E_b=1x10^5 N/mm^2.	BTL5	Evaluate
11	A reinforced concrete column 500 mm x 500 mm in cross section is reinforced with 4 steel bars of 25 mm diameter, one in each corner, the	BTL5	Evaluate

	column is carrying a load of 1000 kN. Find the stresses in the concrete and steel bars. Take the value of E for steel is 210 x 10^3 N/mm^2 and for concrete is 14 x 10^3 N/mm^2.		
12	A circular rod is subjected to a pull of 60 kN. The measured extension on a guage length of 180 mm is 0.09 mm and the change in diameter is 0.00276 mm. Calculate the Poisson's ration and the value of other moduli if young's modulus is 200 kN/mm^2.	BTL5	Evaluate
13	A rectangular block of material is subjected to a tensile stress with the value of 110 N/mm^2 on one plane and tensile of 47 N/mm^2 on a plane at right angles to the former. Each of the above stresses is accompanies by a shear stress of 63 N/mm^2. Determine the principal stresses and maximum shear stress.	BTL5	Evaluate
14	The stresses at a point in a strained material in X and Y directional plane is 200 N/mm^2 and -150 N/mm^2 and the value of q is 800 N/mm^2. Find the principal plane and principal stresses using graphical method and verify with analytical method.	BTL5	Evaluate
15	Two planes AB and AC which are right angles to carrying shear stress of intensity 17.5 N/mm^2 while these planes carrying a tensile stress with the value of 70 N/mm^2 and a compressive stress of 35 N/mm^2 respectively. Find principal plane, principal stresses, maximum shear stresses and planes on which act.	BTL5	Evaluate
16	A steel rod of 30 mm diameter passes centrally through a copper tube of 60 mm external diameter and 50 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 60˚C, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/ m^2 and 100 GN/m^2 and α for steel and copper as 12 x 10-6 per ˚C and 18 x 10-6 per ˚C.	BTL5	Evaluate
17	A specimen of steel 20 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 80 kN and the load at elastic limit is 102 kN. The maximum load is 130 kN. The total extension at fracture is 56 mm and diameter at neck is 15 mm. Find (i) The stress at elastic limit. (ii) Young's modulus. (iii) Percentage elongation. (iv) Percentage reduction in area. (v) Ultimate tensile stress	BTL5	Evaluate
18	At a point in a strained material, the principal stresses are 100 N/mm^2 tensile	BTL5	Evaluate

	and 60 N/mm^2 compressive. Determine normal stress, shear stress and resultant stresses on a plane inclined at 50 to the axis of major principal stress.		

UNIT-II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAMS Beams –types of beams- types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams –Shear stress distribution.			
Sl. No	**Questions**	**BTL**	**Compliance**
PART-A (2 Marks)			
1	Classify beams based on the supports.	BTL2	Understanding
2	Name the various types of loading.	BTL1	Remembering
3	Define shear force and bending moment.	BTL2	Understanding
4	Describe the term point of contra flexure.	BTL2	Understanding
5	Describe the theory of simple bending.	BTL2	Understanding
6	Define flitched beam.	BTL1	Remembering
7	Discriminate overhanging beam with continuous beam.	BTL2	Understanding
8	Compare overhanging beam with continuous beam.	BTL2	Understanding
9	Describe section modulus.	BTL2	Understanding
10	Describe about transverse loading on beams.	BTL2	Understanding
11	What is meant by sagging in bending moment?	BTL1	Remembering
12	What is meant by hogging in bending moment?	BTL1	Remembering
13	A cantilever beam of 4m length is subjected to a UDL of 20 kN/m over its entire length.	BTL3	Apply
14	A cantilever beam of 6m length is subjected to a point load of 10 kN/m at free end. Find the maximum bending moment.	BTL3	Apply
15	A simply supported beam of 6m length is subjected to a UDL load of 10 kN/m over its entire length. Find the maximum bending moment.	BTL3	Apply
16	Sketch the BM diagram of a cantilever beam subjected to UDL over the entire span.	BTL1	Remembering
17	Sketch the bending stress distribution and shear stress distribution for a beam of rectangular cross section.	BTL3	Apply
18	Write down relations for maximum shear force and bending moment for cantilever beam subjected to UDL over entire span.	BTL1	Remembering
19	Write down bending moment equation.	BTL1	Remembering
20	List out the assumption made for theory of bending.	BTL1	Remembering
21	Find the section modulus of circular section of diameter 30 mm.	BTL3	Apply

22	Write the equation of section modulus for circular and hollow circular sections?	BTL1	Remembering
23	Draw the BMD for a simply supported beam of span L carrying uniformly varying load from 0 to “W” KN / m for the entire span.	BTL3	Apply
24	Illustrate the shear stress distribution in a solid circular section.	BTL3	Apply
25	What do you mean by beam of uniform strength?	BTL1	Remembering
PART-B (16 Marks)			
1	A cantilever beam length of length 2 m carries the point load of 1 kN at its free end and another load of 2 kN at 1 m from free end. Draw SF and BM diagrams for the cantilever beam.	BTL5	Evaluate
2	A cantilever beam length of length 2 m carries a Uniformly Distributed Load (UDL) of 3 kN/m in the entire span. Draw SF and BM diagrams for the cantilever beam.	BTL5	Evaluate
3	A cantilever beam length of length 4 m carries a Uniformly Distributed Load (UDL) of 3 kN/m run over the entire span and two point loads of 4 kN and 2.5 kN are placed 1m and 2 m respectively from the fixed end. Draw SF and BM diagrams for the cantilever beam.	BTL5	Evaluate
4	A cantilever beam length of length 3 m carries a Uniformly Distributed Load (UDL) of 12 kN/m run over the length of 1.5 m from the free end. It is also carrying a point load of 15 kN at free end and 8 kN at 1 m from the fixed end. Draw SF and BM diagrams for the cantilever beam.	BTL5	Evaluate
5	A cantilever beam of length of 5 m length is loaded by a point load of 2 kN, 2 kN and 3 kN at 1.5 m, 3 m and 5m respectively from the fixed end. It is also carrying UDL of 3 kN/m to the length of 1.5 m after the first point load from the left end. Draw SF and BM diagrams for the cantilever beam.	BTL5	Evaluate
6	A cantilever beam length of length 3 m carries a Uniformly varying Load (VDL) of zero at the free end to 1 kN/m at the fixed end. Draw SF and BM diagrams for the cantilever beam.	BTL5	Evaluate
7	Drive the expression of SSB and BMD for a cantilever beam subjected to Uniformly Distributed Load to the entire span.	BTL3	Apply
8	Drive the expression of SSB and BMD for a simply supported beam subjected to Uniformly Distributed Load to the entire span.	BTL3	Apply
9	A simply supported beam of 5 m length carries point loads of 3 kN, 4.5 kN and 7 kN at 1 m, 2.5 m and 3.5 m respectively from the left hand supported. Construct SF and BM diagrams.	BTL5	Evaluate

10	A simply supported beam length of length 8 m carries a Uniformly Distributed Load (UDL) of 4 kN/m run over entire length and carrying a point load of 2 kN and 5 kN at 3 and 6 m respectively from the right support. Draw SF and BM diagrams of simply supported beam.	BTL5	Evaluate
11	A simply supported beam length of length 4 m carries a UDL of 10 kN/m run over the right hand half of the span and carrying a point load of 22 kN at a distance of 1 m from the left support. Draw SF and BM diagrams of simply supported beam.	BTL5	Evaluate
12	A simply supported beam length of length 7 m carries a UDL of 12 kN/m run over 3 m and 1.5 m away from the right. In addition, it has a load 8 kN at 2.5 m from the left hand support. Draw SF and BM diagrams of simply supported beam.	BTL5	Evaluate
13	A simply supported beam length of length 8 m carries a UDL of 1500 N/m run over entire span and three concentrated load of 1000 N, 2000 N and 4000 N acting at right quarter, center point and right quarter respectively. Draw SF and BM diagrams of simply supported beam.	BTL5	Evaluate
14	A simply supported beam length of length 8 m carries a VDL of 1 kN/m from the left hand support and 2 kN/m to the right hand support. Construct the shear force diagram and bending moment diagram.	BTL5	Evaluate
15	A beam of 12 m long is supported at two points of 2 m from each end, so that there are two equal overhanging portions. It carries a concentrated loads of 4 kN, 3 kN and 5 kN at 1 m, 8 m and 12 m respectively from the left end. Construct the shear force diagram and bending moment diagram.	BTL5	Evaluate
16	A beam of 8 m long is supported at left end and at a point of 6 m from right end. It carries two concentrated loads of 15 kN and 18 kN, in which one is at the free end and other is at 3 m from the left support. Construct the shear force diagram and bending moment diagram.	BTL5	Evaluate
17	Construct the shear force diagram and bending moment diagram for simply supported beam length of 9 m, subjected to UDL of 10 kN/m for 4 m which is 2 m away from the left support.	BTL5	Evaluate
18	A simply supported beam which is having rectangular in cross section of 60 x 35 mm and 3m long carrying a load of 5kN at mid-span. Determine the maximum bending stress induced in the beam.	BTL5	Evaluate

UNIT-III TORSION Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at both ends – Stresses in helical springs – Deflection of helical springs, carriage springs-Strain energy.			
Sl.No	**Questions**	**BTL**	**Compliance**
	PART-A (2 Marks)		
1	Summarize the assumption for theory of torsion.	BTL2	Understanding
2	A solid shaft is to transmit a torque of 25 kN-m and the shear stress is 60 MPa. Find the diameter of shaft.	BTL3	Apply
3	Describe torsion.	BTL2	Understanding
4	What is the assumption made in torsion equation?	BTL1	Remembering
5	Write the torsional equation.	BTL2	Understanding
6	Write down the expression for the toque transmitted by hallow shaft.	BTL1	Remembering
7	Define polar modulus.	BTL1	Remembering
8	Why hallow circular shafts are preferred when compared to solid circular shaft?	BTL2	Understanding
9	Define torsional rigidity.	BTL1	Remembering
10	Calculate the maximum torque that a shaft of 125mm diameter can transmit, if the maximum angle of twist is 1 degree for a length of 1.5 m and C= 70 x 10^3 N/mm^2.	BTL3	Apply
11	Write down the equation the equation for a maximum shear stress of a solid circular section in a diameter “D” when subjected to torque “T”.	BTL3	Apply
12	Calculate the minimum diameter of shaft required to transmit a torque of 29820 N-m if the maximum shear stress is not to exceed 45 N/mm^2.	BTL3	Apply
13	What is the power transmitted by circular shaft subjected to a torque of 700 kN-m at 110 rpm.	BTL3	Apply
14	Define spring and mention the types of springs.	BTL1	Remembering
15	Define stiffness.	BTL1	Remembering
16	Write the stiffness equation of a closed coiled helical spring subjected to an axial load?	BTL1	Remembering
17	Discriminate closed and open coiled helical springs.	BTL2	Understanding
18	Give shear stress and deflection relation for closed coiled helical spring.	BTL1	Remembering
19	What is meant by spring constant or spring index.	BTL1	Remembering
20	The stiffness of spring is 10 N/mm. What is the axial deformation in the	BTL1	Remembering

	spring when load is 50 N is acting.		
21	What kind of stress introduced when an axial load acts on an open coiled spring?	BTL1	Remembering
22	Write down the equation for shear strain energy of a closed coiled springs?	BTL1	Remembering
23	What is the value of maximum shear stress in a closed coiled helical spring subjected to axial force "W"?	BTL1	Remembering
24	List the stresses induced on springs subjected to load.	BTL2	Understanding
25	Summarize the application of helical spring.	BTL2	Understanding
PART-B (16 Marks)			
1	A hallow shaft is to transmit 200 kW at 80 rpm. If the shear is not to exceed 70 MN/m^2 and internal diameter is 0.5 of the external diameters. Find the external and internal diameters assuming that the maximum torque is 1.6 times the mean.	BTL5	Evaluate
2	A solid shaft diameter of 100 mm is required to transmit 150 kW at 120 rpm. If the length of the shaft is 4 m and modulus of rigidity for the shaft is 75 GPa. Finf the angle of twist.	BTL5	Evaluate
3	A hallow shaft of diameter ratio 3/8 is required to transmit 588 kW at 110 rpm. The maximum torque exceeds the mean by 20%. The shear stress is limited to 63 N/mm^2 and the twist is 0.0081 rad. Calculate the external diameter required to satisfying both conditions. Take the length and rigidity is 3 m and 84 GPa respectively.	BTL5	Evaluate
4	A hallow shaft of 120 mm external diameter and 80 mm internal diameter is required to transmit 200 kW at 120 rpm. If the angle of twist is not to exceed 3°, find the length of the shaft and take C=80 GPa.	BTL5	Evaluate
5	A solid shaft is to transmit 300 kW at 80 rpm. If the shear stress is not to exceed 50 MN/m^2 and diameter ration is 3/7. Find the external and internal diameter if the twist is 1.2° and length is 2 m. Assuming maximum torque is 20% greater than mean and value of C is 80 GN/m^2.	BTL5	Evaluate
6	A solid shaft is to transmit 75 kW at 200 rpm. Find the external and internal diameter if the twist is 1° for the shaft length of 2 m. if the value of shear stress not to exceed 50 N/mm^2 and value of C is 80 GN/m^2.	BTL5	Evaluate
7	A hallow shaft having internal diameter is 50% of its external diameter is transmit 600 kW power at 150 rpm. Find the external diameter of the shaft if shear stress is 65 N/m2 and angle of twist is 1.4° for the shaft	BTL5	Evaluate

	length of 3 m. Assume maximum torque is 1.2 times the mean torque and modulus of rigidity is 1x 10^5 N/mm^2.		
8	A hallow shaft is to transmit 240 300 kW at 110 rpm. If the shear stress is not to exceed 70 MN/m^2, find the diameter of the shaft. If this shaft is replaced by hallow shaft whose internal diameter is 0.6 times of outer diameter. Determine 1. Diameter of the hallow shaft 2. Percentage of saving material, the maximum shear stress being same.	BTL5	Evaluate
9	A hallow shaft of 20 mm thick transmits 300 kW at 200 rpm. Determine the inner diameter of the shaft if the shear strain is 8.6 x 10^{-4} and take C=80 GPa.	BTL5	Evaluate
10	Drive the expression of strain energy stored in a closed coiled helical spring subjected to axial load.	BTL3	Apply
11	A closed coiled helical spring of 8 mm diameter wire with 12 coils of a mean diameter 100 mm carries an axial load of 400 N. Determine the following (1) Shear stress induced (2) Deflection (3) Strain energy stored in a spring.	BTL5	Evaluate
12	A closed coiled helical spring of round steel wire of 100 mm in diameter has a mean radius of 120 mm. The spring has 10 complete turns and is subjected to an axial load of 200 N. Determine the following (1) Maximum Shear stress induced in the wire (2) Deflection of the spring (3) Stiffness of the spring. Take the value of G = 80 kN/mm^2.	BTL5	Evaluate
13	A closed coiled helical spring made of steel wire is required to carry a load of 800 N. Determine the wire diameter if the stiffness of the spring is 10 N/mm and the diameter of helical spring is 80 mm. Calculate the number of turns required in the spring. Give value for G for the steel is 80 GPa and allowable stress is 200 N/mm^2.	BTL5	Evaluate
14	A helical spring is required to carry a total axial force of 50 N and to have a stiffness of 0.4 N/mm. Design the spring using 6 mm in diameter of mild steel bar assuming its shear strength and modulus of rigidity as 96 N/mm^2 and 80 kN/mm^2	BTL5	Evaluate

15	A helical spring in which the mean diameter of the coil is 8 times the wire diameter is to be designed to absorb 0.2 kN-m of energy with an extension of 100 mm. The maximum shear stress is not to exceed 125 N/mm^2 . Determine the mean diameter of the spring, diameter of wire and the total number of turns. Also find the load with which an extension of 40 mm could be produced in the spring. Assume G = 84 kN/mm^2.	BTL5	Evaluate
16	A leaf spring of semi-elliptical type has 10 plates, each 60 mm wide and 5 mm thick. The longest plate 700 mm long. Find the load acting on the spring so that the bending stress shall not exceed 150 N/mm^2 and the central deflection shall not exceed 10 mm. Take E = 2 x 10^5 N/mm^2.	BTL5	Evaluate
17	A carriage steel spring of semi-elliptical type has 100 mm long and width of 50 mm. It carries a central load of 5 kN. If the maximum deflection of the spring not exceed 50 mm and maximum stress should not exceed 150 N/mm^2. Calculate the following (1) Thickness of the plate (2) Number of plates	BTL5	Evaluate
18	A leaf spring is made of 12 steel plates of 50 mm wide and 5 mm thick. It carries a load of 4 kN at the centre. If the bending stress is limited to 140 N/mm^2, Determine the following (1) Length of the spring (2) Deflection at the centre of the spring.	BTL5	Evaluate

UNIT IV DEFLECTION OF BEAMS Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.			
Sl.No	**Questions**	**BTL**	**Compliance**
PART-A (2 Marks)			
1	List the methods used to determine the deflection of beams.	BTL1	Remembering
2	Write the expression of slope of beam using double integration method.	BTL1	Remembering
3	Write the expression of deflection of beam using double integration method.	BTL1	Remembering
4	Classify the types of loading in a beam.	BTL2	Understanding
5	Describe Macaulay's method.	BTL2	Understanding
6	List the disadvantage of double integration method.	BTL1	Remembering
7	Define conjugate beam method	BTL1	Remembering
8	Define modulus of resilience.	BTL1	Remembering
9	State the two theorems in the moment area method	BTL2	Understanding
10	Define proof resilience.		
11	Why moment area method is more useful when compared with double integration?	BTL2	Understanding
12	Define strain energy.	BTL1	Remembering
13	A cantilever beam of 2 m is carrying a point load of 20 kN at its free end. Measure the slope at the free end. Assume EI = 12 x 10^3 kN-m^2.		
14	Compare the moment area method with conjugate beam method for finding the deflection of a simply supported beam with UDL over the entire span.	BTL2	Understanding
15	Define Moher's theorem.	BTL1	Remembering
16	Describe two theorems in the moment area method.	BTL2	Understanding
17	Write the maximum value of deflection for a simply supported beam of constant EI, span L carrying central concentrated load "W".	BTL2	Understanding
18	Write the value of slope at the free end and of a cantilever beam of constant EI and span L carrying central load "W" at free end.	BTL2	Understanding
19	Describe about double integration method.		
20	What is the area of BMD of a cantilever carrying UDL of W/m for the full span of 'L'.	BTL2	Understanding
21	Define Maxwell's reciprocal theorem.	BTL2	Understanding

22	Express the units of slope and deflection.	BTL2	Understanding
23	Write the expression for stress induced in a body when impact load is applied.	BTL1	Remembering
24	Describe the theorem for conjugate beam method.	BTL2	Understanding
25	What is the relation between slope, deflection, and radius of curvature of a beam?	BTL1	Remembering
	PART-B (16 Marks)		
1	Drive the expression of slope and deflection for cantilever beam subjected to point load at the free end.	BTL3	Apply
2	A cantilever beam of 6 m long carries two point loads 15 kN at free end and 25 kN at 2.5 m from the free end. Determine the following by double integration method. 1. Slope at the free end 2. Deflection at the free end	BTL5	Evaluate
3	A cantilever beam of 6 m long carries two point loads 15 kN at free end and 25 kN at 2.5 m from the free end. Determine the following by Macaulay's method. 1. Slope at the free end 2. Deflection at the free end	BTL5	Evaluate
4	A cantilever beam of 4 m long carries a UDL of 8 kN/m length over the entire length. If the section is rectangular of 150 x 260 mm, find the deflection and slope at the free end by moment area method. Take the value of E = 2.1 x 10^5 N/mm^2.	BTL5	Evaluate
5	A cantilever beam of 4 m long carries a UDL of 8 kN/m length over the entire length. If the section is rectangular of 150 x 260 mm, find the deflection and slope at the free end by Macaulay's method. Take the value of E = 2.1 x 10^5 N/mm^2.	BTL5	Evaluate
6	A cantilever projecting 3 m from a wall carries a UDL of 12 kN/m for a length of 2 m from fixed end and a point load of 1.5 kN at the free end. Find the deflection at the free end by double integration method. Take the value of E = 2 x 10^5 N/mm^2 and the value of I = 1 x 10^8 mm^4.	BTL5	Evaluate
7	A cantilever projecting 3 m from a wall carries a UDL of 12 kN/m for a length of 2 m from fixed end and a point load of 1.5 kN at the free end. Find the deflection at the free end by Macaulay's method. Take the value of E = 2 x 10^5 N/mm^2 and the value of I = 1 x 10^8 mm^4.	BTL5	Evaluate
8	A beam of simply supported beam of 6 m long supported at its end is	BTL5	Evaluate

	carrying a point load of 50 kN at its center. The moment of inertia of the beam is equal 78 x 10^6 mm^4. If E for the material is 2.1x10^5 N/mm^2. Calculate the deformation at the center by double integration method.		
9	A beam of simply supported beam of 8 m long supported at its end is carrying a point load of 5 kN at 6 m from left end of the beam. The moment of inertia of the beam is equal 78 x 10^6 mm^4. If E for the material is 2.1x10^5 N/mm^2. Calculate the deformation by double integration method.	BTL5	Evaluate
10	A beam of simply supported beam of 8 m long supported at its end is carrying UDL of 15 kN/m over entire beam. The moment of inertia of the beam is equal 2 x 10^9 mm^4. If E for the material is 2x10^5 N/mm^2. Calculate the deformation at the center by Macaulay's method.	BTL5	Evaluate
11	A SSB of 8 m long carries point load 10 kN at its center. It also subjected to a UDL of 1 kN/m over its entire span. Find deflection of beams by Macaulay's method. Take the inertia of the beam is equal 200 x10^6 mm^4. If E for the material is 200 kN/mm^2	BTL5	Evaluate
12	A cantilever beam of 4 m long carries a UDL of 8 kN/m length over the entire length. If the section is rectangular of 150 x 260 mm, find the deflection and slope at the free end by double integration method. Take the value of E = 2.1 x 10^5 N/mm^2.	BTL5	Evaluate
13	A cantilever beam 7 m carries a UDL of 18 kN/m over a length of 3 m from the free end along with a point load of 2 kN at 3 m from free end. the free end. Find the deflection at the free end by Macaulay's method. Take the value of E = 2 x 10^5 N/mm^2 and the value of I = 1 x 10^8 mm^4.	BTL5	Evaluate
14	A cantilever beam 7 m carries a UDL of 18 kN/m over a length of 3 m from the free end along with a point load of 2 kN at 3 m from free end. the free end. Find the deflection at the free end by double integration method. Take the value of E = 2 x 10^5 N/mm^2 and I = 1 x 10^8 mm^4.	BTL5	Evaluate
15	A SSB span of 6 m long carries UDL of 5 kN/m over length of 3 m extending from left end. Determine the deflection at mid-span by Macaulay's method. Take E= 2x10^5 N/mm^2 and I = 6.2 x 10^6 mm^4.	BTL5	Evaluate
16	A cantilever beam 4 m long carries a load of 50 kN at 2 m from the free end, and load of W at the free end. If the deflection at free end is 25 mm, calculate the magnitude of load W and slope at the free end. Take the value of E= 200 kN/mm^2 and I = 5 x 10^7 mm^4	BTL5	Evaluate

17	Drive the expression of slope and deflection for simply supported beam subjected to point load at the center of beam.	BTL3	Apply
18	A simply supported beam of length 4m long is subjected with a point load of 10 kN and 20 kN at distance of 1 m and 2 m from the left end support. Find the slope at the supports, deflection under load and location and magnitude of the maximum deflection by Macaulay's method. Take E= 2 x 10 ^{4} N/mm^2.	BTL5	Evaluate

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.			
Sl.No	**Questions**	**BTL**	**Compliance**
	PART-A (2 Marks)		
1	Define circumferential stress.	BTL2	Understanding
2	Write the expression for maximum shear in a thin cylinder.	BTL1	Remembering
3	Describe about longitudinal stress on thin cylinder.	BTL2	Understanding
4	Write the expression for longitudinal stress in a thin cylinder subjected to a uniform internal fluid pressure.	BTL1	Remembering
5	List the various methods of reducing the hoop stresses.	BTL1	Remembering
6	Formulate the mathematical expressions of Lame's theorem.	BTL2	Understanding
7	Differentiate the thick cylinder from thin cylinder.	BTL2	Understanding
8	Give the expression for hoop stress for thin spherical shells.	BTL1	Remembering
9	A cylindrical shell 3m long, 1m in diameter and 10 mm thick is subjected to an internal pressure of 2 MPa. Calculate the change in dimensions of the shell. E = 2 x 10^5 N/mm^2.	BTL3	Apply
10	Write the equation for the change in diameter and length of a thin cylinder shell, when subjected to an internal pressure.	BTL1	Remembering
11	Assess the thickness of the pipe due to an internal pressure of 10 N/ mm^2, if the permissible stress is 120 N/mm^2. The diameter of pipe is 750 mm.	BTL3	Apply
12	For the thin cylinder, write down the equation for strain along the circumferential direction.	BTL1	Remembering
13	For the thin cylinder, write down the equation for strain along the longitudinal direction.	BTL1	Remembering
14	For the thin cylinder, write down the expression for volumetric strain.	BTL1	Remembering
15	Write the circumferential strain in thin spherical shell.	BTL1	Remembering
16	In a thin cylindrical shell if hoop strain is 0.2 x 10^{-3} and longitudinal strain is 0.05 x 10^{-3}, find out volumetric strain.	BTL3	Apply
17	Distinguish between cylindrical shell and spherical shell.	BTL2	Understanding
18	Describe the effect of riveting a thin cylindrical shell.	BTL2	Understanding
19	What do you understand by the term wire winding of thin cylinder?	BTL1	Remembering
20	Summarize the assumptions of lame's theory.	BTL2	Understanding

21	Write Lame's equation to find out stresses in a thick cylinder.	BTL1	Remembering
22	In a thick cylinder will the radial stress vary over the thickness of wall and justify.	BTL2	Understanding
23	Define compound cylinder.	BTL1	Remembering
24	List the stresses developed in thick cylinder.	BTL1	Remembering
25	A cylindrical pipe of diameter 1.5 m and thickness 1.5 cm is subjected to an internal fluid pressure of 1.2 N/mm^2. Calculate the longitudinal stress developed in the pipe.	BTL3	Apply
PART-B (16 Marks)			
1	Derive the expressions for change in dimensions of a thin cylinder due to internal pressure.	BTL3	Apply
2	A hallow cylindrical drum 750 mm in diameter and 2.5 m long has a shell thickness of 10 mm. If the drum is subjected to an internal pressure of 2.6 N/mm^2. Determine (i) Change in diameter (ii) Change in length (iii) Change in volume. Take E = 2.1 x 10^5 N/mm^2 and poison's ratio is 0.3. Also calculate change in volume.	BTL5	Evaluate
3	A thin cylindrical shell 3 m long has 1m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and the change in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2. Take E = 2x10^5 N/mm^2 and poison's ratio = 0.3. Also calculate change in volume.	BTL5	Evaluate
4	A cylindrical shell of 1 m long, 150 mm internal diameter having thickness of metal as 7 mm is filled with fluid at atmospheric pressure. If an additional 25 cc of fluid is pumped into the cylinder, fluid pressure exerted by the fluid on the cylinder shell and resulting hoop stress. Assume E = 2 x 10^5 N/mm^2 and poison's ratio is 0.27.	BTL5	Evaluate
5	A cylindrical shell of 2 m long, 600 mm internal diameter having thickness of 12 mm. If it carries a fluid at a pressure of 3 N/mm^2. Determine the longitudinal and hoop stresses in the wall and also determine change in diameter, change in length and change in volume. Assume E = 200 GPa and poison's ratio is 0.3.	BTL5	Evaluate
6	A thin cylindrical shell of 400 mm in internal diameter has shell thickness of metal as 6 mm subjected to an internal pressure which produce a strain of 0.0005 in diameter. Calculate the internal pressure and corresponding longitudinal and hoop stresses. E = 2.1 x 10^5 N/mm^2	BTL5	Evaluate

	and poison's ratio is 0.26.		
7	Derive the expressions for change in dimensions of spherical shell due to internal pressure.	BTL3	Apply
8	Explain briefly about thin spherical shell and derive the expression for hoop stress in thin spherical shell.	BTL3	Apply
9	A thin spherical vessel of 1.5 m internal diameter and 15 mm shell thickness is filled with a fluid at 1.75 N/mm^2. Determine the stress induced in the material of vessel.	BTL5	Evaluate
10	A thin cylindrical shell 3m long, 1.2 m diameter is subjected to an internal pressure of 1.67 N/mm2. If the thickness of the shell is 13 mm, E = 2 x 105 N/mm2 and 1/m = 0.28. (a) Find the circumferential and longitudinal stresses. (b) Find the maximum shear stress and change in dimensions of the shaft.	BTL5	Evaluate
11	A spherical shell of 2 m diameter is made up of 10 mm thick plates. Calculate the change in diameter and volume of the shell, when it is subjected to an internal pressure of 1.6 MPa. Take E = 200 GPa and 1/m = 0.3.	BTL5	Evaluate
12	A steel cylinder of 300 mm external diameter is to be shrunk to another steel cylinder of 150 mm internal diameter. After shrinking the diameter at the junction is 250 mm and radial pressure at the common junction is 40 N/mm2. Find the original difference in the radii at the junction. Take E = 2x105 N/mm^2.	BTL5	Evaluate
13	Find the thickness of metal necessary for a cylindrical shell of internal diameter 150 mm to withstand an internal pressure of 25 N/mm^2. The maximum hoop stress in the section is not to exceed 125 N/mm^2.	BTL5	Evaluate
14	A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1.5m and a wall thickness of 20mm. Calculate the circumferential and longitudinal stresses induced and change in the dimensions of the steel. Cylindrical shell is subjected to an internal pressure of 1.5 N/mm^2 Take $E=2\times10^5$ N/mm^2 and poisons ratio=0.3	BTL5	Evaluate
15	A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure. Length=1.2m, external diameter=20cm, thickness of metal=8mm, Find the value of the pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25cm^3 of liquid is pumped into the cylinder. Take	BTL5	Evaluate

	$E=2.1\times10^5$ N/mm and poisons ratio = 0.33.		
16	Calculate (i) the change in diameter (ii) Change in length and (iii) Change in volume of a thin cylindrical shell 100cm diameter, 1cm thick and 5m long, when subjected to internal pressure of 3 N/mm^2.Take the value of $E=2\times10^5$ N/mm^2 and Poisson's ratio, $\mu=0.3$.	BTL3	Apply
17	A spherical shell of 2 m diameter is made up of 10 mm thick plates. Calculate the change in diameter and volume of the shell, when it is subjected to an internal pressure of 1.6 MPa. Take E = 200 GPa and 1/m = 0.3.	BTL5	Evaluate
18	Derive the expressions for change in dimensions of spherical shell due to internal pressure.	BTL3	Apply